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STEAME ACADEMY
TEACHING FACILITATION LEARNING & CREATIVITY PLAN (L&C PLAN) - LEVEL 2
SERVICE TEACHERS: Tourist routes along natural attractions

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1. Overview

Title	**Tourist routes along natural attractions**
Driving Question or Topic	*How is a tourist route created?* *What algorithms can be used?*
Ages, Grades, …	*12-15 years old* *7-12 grades*
Duration, Timeline, Activities	5 lessons 5 lessons 5 lessons
Curriculum Alignment	What is solving problems by searching? State Space Search Algorithms. Cost optimization. Applications
Contributors, Partners	*School partners from the tourism business*
Abstract - Synopsis	*Initially, students are taught together by the IT teacher, who introduces them to the theoretical framework of problem solving through search. After that, groups of 5-6 students visit a tourist center and study how a certain tourist site can be visited, in what way and by what routes.* *Together with the teachers of information technology, Biology teacher and Entrepreneurship teacher, the groups generate different routes. Together with the art teacher, they create an advertising brochure for the developed route.* *At the next stage, the information technology teacher offers algorithms to optimize the previously created routes. Students calculate the cost of the cheapest, fastest and shortest route. Finally, they present their work.*
References, Acknowledgements	https://www.facebook.com/profile.php?id=100011731180710 https://visit-brezovo.bg/

2. STEAME ACADEMY Framework*

Teachers' Cooperation	***Teacher 1**: IT teacher - this teacher introduces the theoretical aspects of applying search problem solving algorithms. It helps the students in solving the specific tasks, as well as in the preparation of the results and their presentation* ***Teacher 2:** Biology teacher -Acquaintance and popularization of biological diversity in the area* ***Teacher 3:** Art teacher - his/her duties involve assisting students in creating information brochures for the various routes*

	Teacher 4: *Entrepreneurship Teacher – This teacher will help groups of students calculate the optimal values of each route in terms of time, distance and cost. In this way, theoretical knowledge of entrepreneurship will be applied in solving specific practical problems.*
STEAME in Life (SiL) Organization	*Meeting with business representatives – Tourist office* *Entrepreneurship – STEAME in Life (SiL) Days*
Action Plan Formulation	***Step 1***. ***Acquisition of theoretical knowledge:*** *Defining the concepts of routes and finding a route through search algorithms with the IT teacher. The following example task "How to create a route to visit a famous tourist site with different means of transport and on different roads" is defined.* ***Step 2. Getting the assignment and applying the knowledge:*** *Together with the IT, Biology and entrepreneurship teachers, they visit the tourist center in the city and do research on the possibilities of visiting interesting tourist sites in the area - by different roads and with different vehicles.* ***Step 3. Confirmation and analysis of acquired knowledge****: Algorithms for finding a solution to the task are discussed with the IT teacher. Different routes are generated by the individual groups of students. An advertising brochure is created together with the Art teacher.* ***Step 4. Application of knowledge*** *to solve the problem and present the results Together with the teachers of information technology, biology, art and entrepreneurship, routes with optimal values of time, cost and path are sought. The price of the route is calculated. The final version of the advertising brochure is created for each individual route of the respective group. The results are presented to other students and teachers.* ***Step 5. Evaluation.*** *Each teacher follows the assessment level methodology ie. assesses students' teamwork, research and knowledge, presentation and communication skills.*

[*] *under development the final elements of the framework*

3. Objectives and Methodologies

Learning Goals and Objectives	*After completing the training, students should know:* *- How route generation algorithms are implemented and how they are used in the modern world.* *- What does finding an optimal solution mean and what algorithms can we use for this (including using AI)* *- How to promote a tourist route?* *- How to spread the word about the area's biodiversity?*
Learning Outcomes and expected Results	*Students understand the need to use algorithms in solving specific problems in everyday life - such as searching and generating a route.* *Acquisition of skills for project-based learning and teamwork*
Prior Knowledge and Prerequisites	***They should be able to:*** ○ *They solve simple search problems* ○ *To work in a team* ○ *To cooperate in solving practical tasks* ○ *To conduct research* ○ *To plan and organize meetings* ○ *To communicate with business partners* ○ *To analyze the received information*

	○ *To prepare presentations and video clips* ○ *To be creative and generate new ideas* ○ *To present to an audience* ***Expected results:*** ○ *Presentations with analysis and results of finding different routes* ○ *Presentation of advertising brochures for each of the developed routes* ○ *Final conclusions about the most optimal routes according to various criteria* ○ *Real-world application of topics studied in computer science, natural science, and entrepreneurship classes* ○ *Improving knowledge of teamwork*
Motivation, Methodology, Strategies, Scaffolds	*A major task in the plan is to create and experiment with a new approach to studying the very complex topic of search algorithms. Defining specific tasks and applying the most elementary algorithms to solving these tasks (such as finding a route to a specific object) reduces abstractness and allows students to understand the meaning of this knowledge.* *The new role of all teachers is to lead and support student teams in their work. The plan requires both individual and collective work of the students in the team in the initial research and preparation of the presentation of the results to the group.*

4. Preparation and Means

Preparation, Space Setting, *Troubleshooting Tips*	*The leading teacher is Informatics and IT. He/she presents the new knowledge and helps the teams to implement it. Biology, Art and Entrepreneurship teachers support the work of the teams, visiting the tourist center, extracting and analyzing the information received from the partners. All teachers (each according to their competencies) collaborate with students in solving their problem, thus demonstrating the interdisciplinary nature of project-based learning.* *Instructional sources and digital material with the related references needed for the implementation of the learning plan*
Resources, Tools, Material, Attachments, Equipment	*Students work in the classroom or in a computer lab while acquiring new knowledge. They visit a tourist office in the city and work in a team to solve the problem in a STEAME center or other protected environment with their teachers. They prepare an information brochure for the individual tourist routes and presentations of their solutions. Teachers should have appropriate learning resources such as presentations, video files, practical examples, geographical maps, biology materials for eco biodiversity in region of Sredna Gora Mountain, etc.* ● *Knowledge Presentation Video File – https://www.youtube.com/watch?v=V-O-RFSRe-E* ● *Basic AI Search Algorithms Video File - https://www.youtube.com/watch?v=AneIXxdu_g4* ● *Google Maps - https://www.google.com/maps* ● *Presentation on Algorithm A* - https://www.youtube.com/watch?v=vP5TkF0xJgI* ● *Additional resources - https://www.youtube.com/watch?v=Mb1srg1ON60 and https://www.youtube.com/watch?v=eyXynZTshP0* ● *Biodiversity in Bulgaria - https://gis.biodiversity.bg/document-447*

	• *communication and collaboration platform - Google Meet, Google Classroom, Zoom, Skype, etc.* • *e-learning platform - Google classroom, Moodle, etc.*
Health and Safety	*Students and teachers work in a healthy and safe environment.*

5. Implementation

Instructional Activities, Procedures, Reflections	*This plan is developed with an emphasis on classes in Computer Modeling and IT, Art and Entrepreneurship or in a STEAME interest club.* *Covers the subjects of study:* *- Computer Sciences* *- Biology* *- Entrepreneurship* *- Art* *- Presentation and communication skills* *- English* *Teachers plan their activities in Google Calendar as part of the curriculum.* *Teacher 2, Teacher 3 and Teacher 4 follow their usual plans and include examples based on the student teams' area of study.* *Students are actively engaged through hands-on experience and research conducted as independent work that can be discussed in class.* *There are 5 study hours based on a 40-minute lesson. All classes are held once a week with a curriculum for 5 consecutive weeks, and if it is within the training of a STEAME interest club - within 1 week.* *The lead teacher, T1 is involved in the conduct of all lessons:* *- 1-hour introduction to search algorithms* *- 1 hour – participation in a meeting at a tourist office and setting the tasks* *- 1 hour of training on using algorithms to find an optimal solution (route)* *- 1 hour of work on developing solutions to the problem and preparing for its presentation* *- 1 hour for final presentations and feedback sessions which are organized during the last lesson on the topic and a presentation before a jury, including T1, T2, T3, T4 and all students from grades 8, 9, 10 and 11.* *T2, T3 and T4 teachers coordinate their activities with the implementation, including guidelines for interviews with tourism business partners and data analysis, development of information brochures and presentations. They support the teams and give feedback on the work and the final results.*
Assessment - Evaluation	*The presentation of the final results takes place in front of: a jury from T1, T2, T3, T4 classmates, external experts, parents. The main ones components of the presentations are: results of the conducted studies, the search algorithm used, the results of the implementation of the project activity and the route found for visiting a tourist site, the prepared information brochure with the estimated costs and prices.*
Presentation - Reporting - Sharing	*The final conclusions and results of the students are a key success factor. Their own opinion and final recommendations are the main focus so that they can analyze and defend their opinion.*
Extensions - Other Information	*All information brochures are uploaded to the school website and social media posts. Projects can be further developed into case studies and students and teachers can use them in their classes as teaching materials and/or develop further as individual projects.*

STEAME ACADEMY Prototype/Guide for Learning & Creativity Approach
Action Plan Formulation

Major steps in the STEAME learning approach:

STAGE I: Preparation by one or more teachers

1. **Formulating initial thoughts on the thematic sectors/areas to be covered:**
   Route generation is based on the theoretical foundations of search algorithms. Different algorithms exist, some of which quickly lead to a result that is not the best; others - although they seem appropriate, they cannot solve the problem at all; some use prior knowledge of the objects in the state space, while others search "blindly". In the course of training, students must solve a specific problem - finding a route using various search algorithms. In the final stage of the work, the students get to know algorithm for optimal solution to the task according to various criteria. In this stage, they use not only their knowledge of computer modeling, but also of entrepreneurship. The biology teacher participates in the whole process of working on the projects, assisting in determining the location of the main habitats related to the eco-biodiversity of the Sarnena Sredna Gora region. In addition, as part of the project task is the creation of an information brochure for the created route, which also ensures interaction with art education.
2. **Engaging the world of the wider environment / work / business / parents / society / environment/ ethics:**
   Not only the students and their computer science, art and entrepreneurship teachers participate in the training, but also partners from the tourism business, parents and school management.
3. **Target Age Group of Students - Associating with the Official Curriculum - Setting Goals and Objectives**
   The theme is intended for students in grades 8-11 of secondary school. Training can take place in a STEAME club of interest. It can also be organized as part of IT,Math, Biology, Art and Entrepreneurship studies using additional extra-curricular activities and independent study.
4. **Organization of the tasks of the parties involved - Designation of Coordinator - Workplaces etc**.
   The teachers organize the training and support the work of the teams; the partners from the tourist office motivate the students and set a real task to fulfill; the school management supports the organization of meetings with business partners, the extracurricular organization of the work, as well as the presentation of the results to an appropriate audience.

STAGE II: Action Plan Formulation (Steps 1-18)

<u>Preparation (by teachers)</u>

1. **Relation to the Real World – Reflection**
   Presenting a real problem - finding a solution to a problem that involves common sense knowledge and no mathematical algorithm. Students are introduced to some basic search algorithms through examples.
2. **Incentive – Motivation**
   Together with the Biology and Entrepreneurship teacher, students visit a tourist office and complete real-world route generation tasks. Posing a real problem motivates students
3. **Formulation of a problem (possibly in stages or phases) resulting from the above**
   The students are divided into groups and look for the routes by applying the theoretical knowledge obtained. Together with their teachers, they generate optimal routes according to various criteria. Finally, they prepare their information brochure and present the results to a critical audience

Development (by students) – Guidance & Evaluation (in 9-11, by teachers)

4. **Background Creation - Search / Gather Information:**
   New knowledge, applications in solving specific tasks, searching for additional information to solve the problem and find the route - settlements, tourist sites, roads, transport, etc.
5. **Simplify the issue - Configure the problem with a limited number of requirements**
   The route search task is placed clearly with the necessary information
6. **Case Making - Designing - identifying materials for building / development / creation**
   Simple examples are used to understand search algorithms. The task that the individual groups receive is clearly defined
7. **Construction - Workflow - Implementation of projects**
   Introductory training with relevant examples - Posing a real problem - Additional training - Finding a solution to the problem - Presenting the results
8. **Observation-Experimentation - Initial Conclusions**
   Multiple creation of different routes and their optimization
9. **Documentation - Searching Thematic Areas (AI fields) related to the subject under study – Explanation based on Existing Theories and / or Empirical Results**
   Students have the necessary theoretical information and examples.
10. **Gathering of results / information based on points 7, 8, 9**
    At each step, the teacher-moderators report the progress of each group in solving the problem
11. **First group presentation by students**
    Students present the results of their work after applying different search algorithms and finally after applying the algorithms for optimization (from AI and Math)

Configuration & Results (by students) – Guidance & Evaluation (by teachers)

12. **Configure STEAME models to describe / represent / illustrate the results**
13. **Studying the results in 9 and drawing conclusions, using 12**
14. **Applications in Everyday Life - Suggestions for Developing 9 (Entrepreneurship - SIL Days)**

Review (by teachers)

15. Review the problem and review it under more demanding conditions
    It is required to find an optimal solution to the given problem - the search for a route. Initially, it may be required to find an optimal solution according to the criterion of least time, and then to set the students the task of finding an optimal route in terms of distance and cost.

Project Completion (by students) – Guidance & Evaluation (by teachers)

16. Repeat steps 5 through 11 with additional or new requirements as formulated in 15
17. Investigation - Case Studies - Expansion - New Theories - Testing New Conclusions
18. Presentation of Conclusions - Communication Tactics.

STAGE III: STEAME ACADEMY Actions and Cooperation in Creative Projects for school students

Title of Project: ***Tourist routes along natural attractions***

Brief Description/Outline of Organizational Arrangements / Responsibilities for Action

STAGE	**Activities/Steps** Teacher 1(T1) Cooperation with T2, T3 and student guidance	**Activities /Steps By Students** Age Group: 14-19	**Activities /Steps** Teacher 2 (T2) Cooperation with T1, T3, T4 and student guidance	**Activities /Steps** Teacher 3 (T3) Cooperation with T1, T2, T4 and student guidance	**Activities /Steps** Teacher 4 (T4) Cooperation with T1, T2, T3 and student guidance
A	Preparation of steps 1,2,3, 4,5		Cooperation in step 2, 3,4,5	Cooperation in step 3,4,5	Cooperation in step 4,5
B	Guidance in step 9	4,5,6,7,8,9,10	Support guidance in step 9	Support guidance in step 9	Support guidance in step 9
C	Creative Evaluation	11	Creative Evaluation	Creative Evaluation	Creative Evaluation
D	Guidance	12	Guidance	Guidance	Guidance
E	Guidance	13 (9+12)	Guidance	Guidance	Guidance
F	Organization (SIL) STEAME in Life	14 Meeting with Business representatives	Organization (SIL) STEAME in Life	Organization (SIL) STEAME in Life	Organization (SIL) STEAME in Life
G	Preparation of step 15		Cooperation in step 15	Cooperation in step 15	Cooperation in step 15
H	Guidance	16 (repetition 5-11)	Support Guidance	Support Guidance	Support Guidance
I	Guidance	17	Support Guidance	Support Guidance	Support Guidance
K	Creative Evaluation	18	Creative Evaluation	Creative Evaluation	Creative Evaluation